Application No.: 09/240,632 Docket No.: 20402-00568-US

AMENDMENTS TO THE CLAIMS

1. (Previously presented) A method for modulation, comprising the steps of:

regularly subjecting an input digital signal to first modulation and second modulation to convert the input digital signal into a pair of a baseband I signal and a baseband Q signal, the first modulation and the second modulation being different from each other; and

outputting the pair of the baseband I signal and the baseband Q signal;

wherein the first modulation is at least 8-signal-point modulation, and the second modulation is phase shift keying;

wherein the phase shift keying provides periodically-spaced symbols which represent corresponding portions of the input digital signal in terms of differences between phases of the periodically-spaced symbols; and

wherein the at least 8-signal-point modulation assigns logic states of the input digital signal to respective signal points for a first symbol in response to a signal point used by a second symbol of the phase shift keying which precedes the first symbol.

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2. Cancelled

3. (Currently amended) A method as recited in claim 1, wherein the phase shift keying is [quadranture] quadrature phase shift keying.

4. (Original) A method as recited in claim 2, wherein the phase shift keying is quadrature phase shift keying.

5. (Currently amended) A method as recited in claim 1, wherein the at least 8-signal-point modulation is at least 8 [quadature] quadrature amplitude modulation.

6. (Original) A method as recited in claim 4, wherein the at least 8-signal-point modulation is at least 8 quadrature amplitude modulation.

PAGE 8/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

7. (Original) A method as recited in claim 5, wherein at least 8 quadrature amplitude modulation is 16 quadrature amplitude modulation.

8. (Original) A method as recited in claim 6, wherein the at least 8 quadrature amplitude modulation is 16 quadrature amplitude modulation.

9. (Original) A method as recited in claim 5, wherein the at least 8 quadrature amplitude modulation provides signal points which result from rotation of signal points of at least 8-value normal quadrature amplitude modulation through an angle of $\pi/4$ radian about an origin in an I-Q plane.

10. (Original) A method as recited in claim 6, wherein the at least 8 quadrature amplitude modulation provides signal points which result from rotation of signal points of at least 8-value normal quadrature amplitude modulation through an angle of $\pi/4$ radian about an origin in an I-Q plane.

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11. (Original) A method as recited in claim 7, wherein the 16 quadrature amplitude modulation provides signal points which result from rotation of signal points of 16-value normal quadrature amplitude modulation through an angle of $\pi/4$ radian about an origin in an I-Q plane.

12. (Original) A method as recited in claim 8, wherein the 16 quadrature amplitude modulation provides signal points which result from rotation of signal points of 16-value normal quadrature amplitude modulation through an angle of $\pi/4$ radian about an origin in an I-Q plane.

13. (Previously presented) A method as recited in claim 1, wherein a maximum of amplitudes corresponding to signal points of the at least 8-signal-point modulation in an I-Q plane is equal to an amplitude of a signal point of the phase shift keying in the I-Q plane.

PAGE 9/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

Claims 14-32 (cancelled).

33. (Currently amended) A transmission apparatus comprising:

first means for periodically and alternately subjecting an input digital signal to first modulation and second modulation to convert the input digital signal into a pair of a baseband I signal and a baseband Q signal, the first modulation and the second modulation being different from each other, the first modulation being at least 8-signal-point modulation, the second modulation being phase shift keying; [and]

second means for outputting the pair of the baseband I signal and the baseband Q signal;

wherein the first modulation is at least 8-signal-point modulation, and the second modulation is phase shift keying;

wherein the phase shift keying provides periodically-spaced symbols which represents corresponding portions of the input digital signal in terms of differences between phases of the periodically-spaced symbols;

wherein the at least 8-signal-point modulation assigns logic states of the input digital signal to respective signal points for a first symbol in response to a signal point used by a second symbol of the shift keying which precedes the first symbol; and

wherein said first symbol is demodulated by using said second symbol which is not a known prescribed pattern but a part of information transmitted by said transmission apparatus.

Claims 34-36 (cancelled).

37. (Previously presented) A transmission apparatus as recited in claim 33, wherein the symbols provided by the phase shift keying are used as a pilot symbol for estimating at least one of (1) a transmission path distortion and (2) a frequency offset.

PAGE 10/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

38. (Currently amended) A modulation method for modulating an input digital signal into a multi-value symbol stream, the modulation method comprising:

generating a first multi-value modulation signal having first multi-value symbols with a first modulator;

generating a second modulation signal containing second multi-value symbols by using a second modulator which are to be used as pilot symbol estimating at least one of (1) a channel distortion and (2) a frequency offset for demodulating said first multi-value modulation signal in a receiver; [and]

inserting said second multi-value symbols into said first multi-value symbols such that the resultant multi-value symbols constitute said multi-value symbol stream; and

wherein said first symbol is demodulated by using said second symbol which is not a known prescribed pattern but a part of information to be transmitted and received.

39. (Previously presented) A modulation method as recited in claim 38, (1) said channel distortion and (2) said frequency offset are estimated from each of said second multi-value symbols.

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40. (Previously presented) A modulation method as recited in claim 38, wherein differential encoding is done between symbols of the second modulation signal.

41. Cancelled

42. (Currently amended) A modulation method as recited in [one of claims] claim 38, wherein the second modulation signal is obtained by phase shift keying (PSK) modulation.

43. (Currently amended) A modulation method as recited in claim 42, wherein the second modulation signal is obtained by binary phase shift keying (BPSK) modulation.

PAGE 11/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

44. (Currently amended) A modulation method as recited in claim 42, wherein the second modulation signal is obtained by quadrature phase shift keying (QPSK) modulation.

45. Cancelled

46. (Currently amended) A modulation method as recited in [one of claims] claim 38, wherein the first modulation signal is obtained by at least 8-value modulation.

47. (Currently amended) A modulation method as recited in claim 46, wherein the first modulation signal is at least an 8-value quadrature amplitude modulation (QAM).

48. (Currently amended) A modulation method as recited in [one of claims] claim 38, wherein the first modulation signal is obtained by 16QAM and the second modulation signal is obtained by PSK modulation, and a maximum signal point amplitude of the second modulation system is equal to 0.9 to 1.5 times a maximum signal point amplitude of the first modulation signal.

49. (Previously presented) A transmission apparatus comprising a first multi-value modulation system for subjecting an input digital signal to first modulation and outputting a first quadrature baseband signal, a second modulation system for subjecting the input digital signal to a second modulation and outputting a second quadrature baseband signal, wherein said second quadrature baseband signal is regularly inserted as a pilot signal into the first quadrature baseband signal wherein said second quadrature baseband signal is used for estimating a frequency offset and a channel distortion in a receiver.

50. Cancelled

PAGE 12/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

51. (Previously presented) A transmission apparatus as recited in claim 49, wherein differential encoding is done between symbols of the second modulation system.

52. Cancelled

53. (Previously presented) A transmission apparatus as recited in one of claims 49 or 51, wherein the second modulation system is phase shift keying (PSK) modulation.

54. (Previously presented) A transmission apparatus as recited in claim 53, wherein the second modulation system is binary phase shift keying (BPSK) modulation.

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55. (Previously presented) A transmission apparatus as recited in claim 53, wherein the second modulation system is quadrature phase shift keying (QPSK) modulation.

56. Cancelled

57. (Previously presented) A transmission apparatus as recited in one of claims 49 or 51, wherein the first modulation system is at least 8-value modulation.

58. (Previously presented) A transmission apparatus as recited in claim 57, wherein the first modulation system is at least 8-value quadrature amplitude modulation (QAM).

59. (Previously presented) A transmission apparatus as recited in one of claims 49 or 51, wherein the first modulation system is 16QAM and the second modulation system is PSK modulation, and a maximum signal point amplitude of the second modulation system is equal to 0.9 to 1.5 times a maximum signal point amplitude of the first modulation system.

PAGE 13/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

60. (Withdrawn) A receiving apparatus for receiving a modulation signal of a first multi-value modulation system, and a modulation signal of a second modulation system which is regularly inserted into the multi-value modulation system, the apparatus comprising:

an estimating portion for extracting a signal estimating a channel distortion of the second modulation system from a quadrature baseband signal of the second modulation system; and

a detecting portion for modulating the first modulation system from the quadrature baseband signal and the transmission path distortion estimation signal, and for outputting data.

61. (Withdrawn) A receiving apparatus for receiving a modulation signal of a multi-value modulation system of a first modulation system, and a modulation signal of a second modulation system which is regularly inserted into the signal of the multi-value modulation system, the apparatus comprising:

a frequency offset estimating portion for extracting a signal of the second modulation system from a quadrature baseband signal, and for outputting a frequency offset estimation signal; and

a detecting portion for modulating the first modulation system from the quadrature baseband signal with the frequency offset estimation signal.

62. (Withdrawn) A receiving apparatus for receiving a first modulation signal of a multi-value modulation system, and a second modulation signal of a second modulation system which is regularly inserted into the first multi-value modulation signal, the apparatus comprising:

a channel distortion estimating portion for extracting a signal of the second modulation system of a received quadrature baseband signal of said first and second signals, for estimating a channel distortion, and for outputting a channel distortion estimation signal;

a frequency offset estimating portion for estimating a frequency offset from said extracted signal of the second modulation system, and for outputting a frequency offset estimation signal; and

a detecting portion for modulating the first modulation system signal from the quadrature baseband signal, the channel distortion estimation signal, and the frequency offset estimation signal, and for outputting data.

PAGE 14/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

63. (Withdrawn) A receiving apparatus for receiving a first modulation signal of a multi-value modulation system, and a second modulation signal of a second modulation system which is regularly inserted into the first multi-value modulation signal, the apparatus comprising:

a demodulating portion for extracting a signal of the second modulation system from a quadrature baseband signal of said first and second modulation signals, and for outputting corresponding data;

a distortion estimating portion for extracting a signal of the second modulation signal channel of the quadrature baseband signal, for estimating a channel distortion, and for outputting a channel distortion estimation signal; and

a detecting portion for demodulating the first modulation signal from the quadrature baseband signal, and the channel distortion for outputting data of the first modulation signal.

64. (Withdrawn) A receiving apparatus for receiving a first modulation signal of a multi-value modulation system, and a second modulation signal of a second modulation system regularly inserted into the first modulation signal, comprising:

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a demodulating portion for extracting said signal of the second modulation system from a quadrature baseband signal of said first and second modulation signals;

a frequency offset estimating portion for extracting a signal of the second modulation signal of the quadrature baseband signal, for estimating a frequency offset, and for outputting a frequency offset estimation signal; and

a detecting portion for modulating the first modulation signal from the quadrature baseband signal and the frequency offset estimation signal, and outputting data.

65. (Withdrawn) A receiving apparatus for receiving a first modulation signal of a multi-value modulation system, and a second modulation signal of a second modulation system regularly inserted into the first modulation signal of the multi-value modulation system, comprising:

a demodulating portion for extracting a signal of the second modulation signal from a quadrature baseband signal of said first and second signals for outputting data;

PAGE 15/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

a channel distortion estimating portion for extracting a signal of the second modulation signal of the quadrature baseband signal for estimating a channel distortion, and for outputting a channel distortion estimation signal;

a frequency offset estimating portion for extracting a signal of the second modulation signal of the quadrature baseband signal, for estimating a frequency offset, and for outputting a frequency offset estimation signal; and

a detecting portion for modulating the first modulation signal of the quadrature baseband signal, the channel distortion estimation signal, and the frequency offset estimation signal, and outputting data.

66. (Withdrawn) A receiving apparatus as recited in one of claims 63, 64 or 65, wherein a detection system for the second modulation signal is delay detection.

67. (Withdrawn) A receiving apparatus as recited in one of claims 63, 64, 65 or 66, wherein a detecting portion for the first modulation system is quasi synchronous detection.

68. (Withdrawn) A receiving apparatus as recited in one of claims 63, 64, 65, 66 or 67, wherein the second modulation system is phase shift keying (PSK) modulation.

69. (Withdrawn) A receiving apparatus as recited in claim 68, wherein the second modulation system is binary phase shift keying (BPSK) modulation.

70. (Withdrawn) A receiving apparatus as recited in claim 68, wherein the second modulation system is quadrature phase shift keying (QPSK) modulation.

71. (Withdrawn) A receiving apparatus as recited in one of claims 63, 64, 65, 66 or 67, wherein the first modulation system is quadrature phase shift keying (QPSK) modulation.

72. (Withdrawn) A receiving apparatus as recited in one of claims 63, 64, 65, 66 or 67, wherein the first modulation system is at least 8-value modulation.

PAGE 16/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30

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73. (Withdrawn) A receiving apparatus as recited in claim 72, wherein the first modulation system is at least 8-value quadrature amplitude modulation (QAM).

PAGE 17/21 * RCVD AT 12/29/2003 3:32:34 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:2022936229 * DURATION (mm-ss):05-30